

DIGITAL GOVERNMENT AS SERVICE DELIVERY FOR DIFFICULT TERRITORY A CASE STUDY OF BONIN ISLANDS

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Abstract

The paper analyses the potential of digital technology to deliver public services in difficult places to discuss the equity and equality issues of public services, through a case of Bonin Islands in Japan. It examines and discusses the issues of these difficult areas in terms of public service delivery from theoretical as well as practical aspects, and to explore the potential of digital technology, which has enabled various services and has created new opportunities.

1. Introduction

Modern nation States have promoted integration among populations and territories, while conserving and guaranteeing various diversities. European Union, for example, has been promoting integration of the member states, while guaranteeing their diversities. However the recent financial difficulties have been forcing many member states to cut their budget on these issues.

In order to examine the issue of diversity, the concept of insularity (Ottaviano, 2007) would provide an interesting view as explored in this paper. Inside a country, remote territories provide various diversities; however guaranteeing equal public services to these areas could be a big burden to the government. In case of islands territories, the benefit includes richness in climate, vegetation, and resources, as well as guaranteeing Exclusive Economic Zone (EEZ) [20]. Thus, the cost for service delivery could be compensated with the possible economic activities and the resources, produced by and in the EEZ. Even though, the austerity tendency has made the governments' investment to these areas difficult to justify and some have brought the privileges of these areas into discussion.

Some of these regions have developed excellences in public service delivery worth investigating. There are various cases which are considered to be innovative, not only because of its ICT use, but also for its ideas and challenges. Insularity seems to strengthen the local identity and favours its promotion. Previous studies show that the limited partners due to their geographical positions create positive synergies between actors and thus innovation in public service delivery; in some other cases, various founding for insularity plays an important role to create opportunities [19].

The paper analyses case of Bonin Islands in Japan, in order to examine and explore the potential of ICT, which has enabled various services and has created new opportunities. The Islands have positive impact on guaranteeing diversity to the country through their unique ecosystem, recognized as UNESCO World Natural Heritage, and wide EEZ, which produces and would produce rich aquatic and mineral resources. The territory also has significant impact on the national security.

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Thus, despite the high cost, it is essential to maintain the services to the inhabitants. And ICT, indeed, has proved to be an important element for the service provision.

2. Digital Governance as Alternative Public Service Delivery

Information and Communication Technology (ICT) is considered to be introduced in public administration along with other new managerial techniques, especially under the New Public Management (NPM) concept in the Nineties. With NPM, the use of ICT started to focus on managerial process of public administration. Various managerial tools enabled by ICT were introduced to improve the speed and transparency of administrative procedure. Exchange of documents and elaboration through multiple actors became easier, thus improving interaction and collaboration among stakeholders. Not only the internal managerial issues, but also the public service delivery utilizing and benefitting from ICT, especially web-based technologies became popular. Many former counter services were transformed into on-line services, making citizen possible to access directly to information as well as public services.

E-Government has been challenged with “digital era governance”, which goes beyond the NPM. In this view, all stakeholders are related in public governance network. The introduction of New Public Governance (NPG) in public service delivery is an important turning point as concept as well as practice. Citizens and communities are invited to participate not only in the decision-making process, but also the service delivery process, thus realizing co-design, co-creation, and co-production. They are redesigning the structure of service delivery.

Digital services of governments have become an importance aspect of technology and/or innovation driven public services. This concept as well as practice was enabled through various elements, including co-design and co-production with citizens and other stakeholders, digital technologies enabling data analytics, thus better designing services, based on data and evidences, NPG helped the realisation of co-production with citizens and other stakeholders, while NPG encouraged ICT to be an effective and efficient instrument of government. Many of the digital services are not only a result of technological innovation and advancement, but also a product of institutional reform and revolution. ICT, per se, is not a solution, but could offer and become an opportunity.

3. Insularity and its theoretical Background

There are studies from legal, normative, economic, and territorial development points of view; the paper focuses on the insularity first from normative point of view, especially in EU context, which has developed an elaborated system on this issue, and then from New Economic Geography (NEG).

3.1. Insularity in EU Context

Ultra-peripheral regions (UPRs) and outermost regions (OMRs) have various characteristics which distinguish themselves from their main territory as well as the territory of EU. They have economic and political importance to their states as well as EU. Their diversity has considered important in contrast to the European unity. Article 299 n.2 of the Treaty of Amsterdam acknowledges that the UPRs have specific characteristics that differentiate them from other European regions. The European Council is assigned the task of designing the conditions under which the Treaty applies to those regions within the framework of the internal market and common policies.

The Treaty of Lisbon redefined the concept with OMRs. OMRs are geographic areas, which are part of an EU Member State, are situated outside of Europe and are fully part of the EU. According to the Treaty on the Functioning of the European Union, both primary and secondary EU law applies automatically to these territories, with possible derogations to take account of their “structural social and economic situation ... which is compounded by their remoteness, insularity, small size, difficult topography and climate, economic dependence on a few products, the permanence and combination of which severely restrain their development ...”². As of April 2014, a total of nine territories (six French: Guyana, Guadeloupe, Martinique, Mayotte, Réunion, Saint Martin; two Portuguese: Azores and Madeira; and one Spanish: Canary Islands) were registered to have OMR status.

The task is daunting because UPRs or OMRs are “a case apart” [7]. These are regions that belong to the EU but, at the same time, also to geographical and economic areas that are not European. Not only they are far from their national mainland but they are also close to non-European countries that are much less developed. As a result, their situation is characterized by remoteness, insularity³, small size, difficult topography, harsh climatic conditions, and strong dependence on few products [12]. OMRs have many issues due to their remoteness from major territories of EU; however thanks to the characteristics, especially of their geography and climate, they have been serving as important research fields as well as industrial hubs. They supply rum, sugar, tropical fruits and vegetables to European market and consumers, thus guaranteeing the diversity in EU. They are strategic territories for EU diplomacy with non-EU neighbouring countries.

It is important to define strategy towards OMRs by examining their specificities from economic theory. In particular, there are some key questions: has the concept of ‘outermost’ received any attention in economic models?; what implications those models have on OMRs?; what insight do they provide on development policies for those regions? These questions are tackled from ‘New Economic Geography’ (NEG), an approach to economic geography firmly grounded on recent developments in mainstream industrial organization and international trade theory.

3.2. Insularity by New Economic Geography (NEG)

According to NEG the growth opportunities of a region depend on the relative size of its local market (‘market-seeking attraction’), its comparative advantage (‘cost-seeking attraction’) and its position in the national and international trade network (‘accessibility’). These characteristics nicely fit the concept of ‘outermost’ according to which ‘outermost’ is the combination of weak attraction and bad accessibility. That is indeed what differentiates OMRs from central regions (strong attraction and good accessibility), peripheral regions (strong attraction but bad accessibility), and marginal regions (weak attraction but good accessibility) [11].

When observing geographical asymmetries in economic development, the first obvious explanation is that regions differ in terms of their relative abundance of natural resources, their proximity to natural means of communication, and their climatic conditions. All these characteristics define the exogenous attributes of a region (‘first nature’) and they play centre stage in traditional trade theories of comparative advantage along the lines drawn by Ricardo, Heckscher and Ohlin [5]. In particular, those theories argue that international cost differences foster the concentration of industries in countries where the corresponding costs are lower (‘cost-saving attraction’). For a specific sector, these are regions that: 1) use relatively advanced technologies in the sector; 2) are

² Article 349 (ex Article 299(2)) of the Treaty on the Functioning of the European Union.

³ Even ‘double-insularity’ as some OMRs consist of groups of islands themselves rather far from one another.

relatively abundant in the factor in which the sector is relatively intensive; 3) offer better local infrastructures for transporting intermediate goods. Nevertheless, dramatic differences in economic development can be observed even between areas that are not very different in terms of those exogenous attributes. This suggests that the observed regional unbalances must be driven by some other forces ('second nature') that are inherent to the functioning of economic interactions and that, in principle, are able to generate uneven development even across ex-ante identical places.

Second nature explanations have a long history in economics, geography, and regional science [9]. However, the debate within mainstream economics has been dominated by NEG⁴. With respect to alternative approaches, the defining feature of NEG is its focus on market rather than non-market interactions. This is pursued within a 'general equilibrium' framework stressing the endogenous determination of good and factor prices and the importance of economy-wide budget constraints⁵. This section aims to illustrate the main features of NEG. The corner stone of NEG is the location decision of the firm⁶. It is also a well-defined theoretical problem provided that the firm has some market power⁷. Increasing returns to scale at the plant level and costly transportation then generate an economic trade-off between the 'proximity' to dispersed customers and suppliers on the one hand, and the 'concentration' of production in few large plants on the other. Hence, international differences in local market size foster the agglomeration of industries in larger countries ('market-seeking attraction')⁸. The firm's location decision is made more complex by the interactions with other firms. Product and factor market competition promotes the geographical dispersion of industries ('market-crowding repulsion'). Since firms have market power, plant-level scale economies have also crucial implications in terms of welfare. The reason is that the prices, on which consumers and firms base their consumption, production and location decisions, do not fully reflect the corresponding social values. This means that market interactions generate 'side effects' for which no quid-pro-quo is paid. Being associated with market transactions those 'side effects' are called 'pecuniary externalities'. Alternative approaches to NEG stress the role of 'technological' rather than 'pecuniary' externalities⁹.

Technological externalities differ from pecuniary ones in that they materialize through sheer physical proximity independently from any market transaction¹⁰. As they arise from non-market interactions, also for them no quid-pro-quo is paid. The productivity of a firm is influenced by the presence of other firms nearby even without any market relation with them. For instance, nearby firms may increase a firm's productivity through informal knowledge transmission ('spillover'), generated as a by-product of their contacts with the surrounding environment. The logical advantage of pecuniary externalities lies in the possibility of relating their emergence to a set of well-defined microeconomic parameters. This has proven to be quite difficult in models based on technological externalities as these still remain mostly 'black boxes'¹¹.

⁴ After more than a decade since the seminal work by [17], NEG has grown into a mature body of literature as testified by a rich list of surveys and textbooks such as [30], [10], [27], [31], [32], [9], [2], [28], [29].

⁵ In the words of [8]: "you want a general-equilibrium story, in which it is clear where the money comes from and where it goes".

⁶ [34] explores the 'folk theorem of spatial economics'.

⁷ See [35]. Firms have market power when they do not take market prices as given as perfectly competitive firms would. Under such a price-making behaviour, called 'imperfect competition', firms trade quantity against price in making their profit-maximizing decisions.

⁸ This is sometimes called the 'home market effect' [16], [13], whereby firms tend to solve the trade-off between proximity and concentration by serving the smaller market from the larger one.

⁹ The distinction between pecuniary and technological externalities is due to [33].

¹⁰ [22], [14] as well as [4] for a recent reassessment.

¹¹ [31] as well as [6] for recent assessments.

Three possible scenarios are especially relevant for NEG. The first provides an example of market-crowding repulsion. When a firm relocates, it decreases competition in the place of origin and increases competition in the place of destination. A pecuniary externality materializes in both places in so far as the relocating firm disregards those effects. In particular, the relocating firm imposes a positive externality on its competitors in the place of origin and a negative externality on its competitors in the place of destination. By pushing down profits in places crowded by firms, competition acts as a dispersion force [32]. The second scenario is an example of market-seeking attraction and considers the effect of firm relocation when matched by labour migration. In this case, as the firm moves, it reduces demand in the place of origin while increasing it in the place of destination. As profits rise with demand, the firm imposes a negative externality on competitors in the former place and a positive one on competitors in the latter. By raising profits in places crowded by firms, market size therefore acts as an agglomeration force [17]. In the third scenario cost-saving attraction is at work. Firms are linked by input-output linkages: what is output for a firm is input for the others and vice versa. When a firm relocates, it depresses both final demand and intermediate supply in the place of origin, whereas it reinforces them in the destination. Other firms' profits suffer in the former place, where the firm imposes a negative externality, and thrive in the latter, where it imposes a positive externality. By raising profits in places crowded by firms, input-output linkages therefore act as an agglomeration force [18] [37].

The geographical distribution of demand and the position of other firms determine the relative attractiveness to a firm of alternative locations through market or non-market interactions. This creates a feedback mechanism among firms' location decisions through which firms' interactions ('second nature') may alter the economic landscape implied by natural resources, natural means of communication, and climatic conditions ('first nature'). Since 'second nature' is driven by localized externalities, in a free market the location of firms is generally inefficient and appropriate public intervention is needed.

NEG explains the public service delivery difficulties in isolated places. The following case study, however, would illustrate that the technological aspect, especially digital technology eventually can compensate the geographical distance, confirming the alternative approaches to NEG which stress the role of technological externalities.

4. Bonin Islands and their Issues

Japan is an island country with 6,852 islands of international definition. Many of them are located in coastal areas and/or in inland seas, but some are in high seas. These remote islands have suffered from low standard of infrastructure, industrial investment, and quality of public services, while their existence is extremely important for the security, natural resources, and economic activity, especially the fishing industry [20].

The government thus enacted law in 1953 to promote the territorial development of remote islands. Since then, every ten years the law have been amended and renewed until the last amendment in 2014. The law has aimed to fill the various gaps between these remote islands and the rest of the territory, investing into infrastructures like water supply and sewage system, port facility, road, and airport, improving quality of life of the residents supplying better education, healthcare and medical services [25]. These legislations have guaranteed the national investment in these territories and thus the general development. In order to guarantee equal public services in these areas, the investment is heavier than in other territories. This has been an argument and dispute from various points of view. Several islands with historical issues, including the occupation during and after the

Second World War, have their own special laws implemented through specific programmes¹². One of them is “Special Law on Development of Ogasawara (Bonin) Islands”, and was enacted first in 1969, revised and amended each 5 years. The last and current law was enacted in 2014 with various development programmes using ICT, especially digital technology. Since then, Bonin Islands saw important improvement in their infrastructure and quality of life, although the islands are located about 1,000 km south to Tokyo and the only passenger ferry runs once a week from and to Tokyo with a travelling time of 24 hours [25]. The islands were recognized as UNESCO World Natural Heritage in 2011 and had experienced a boom in tourism, also thanks to various ICT infrastructure investments which were enabled by the special law.

The research is based on primary documents, semi-structured interviews¹³, field study, and direct observation of the author as a member of the Committee for the Development of Bonin Islands, under the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) from 2007 to 2017.

4.1. Bonin Islands: history, nature, and characteristics

Bonin Islands are under special laws of the MLIT, because of their historical and geographical characteristics, while they belong to Tokyo Metropolitan Government (TMG), but situated 1,000 km south of it and are constituted of around 30 islands, including the main Chichi-jima and Haha-jima, Iwo-to, and Okinotori-shima. The islands with surface of 104km² guarantee about the 30% of Japanese EEZ [26]. Currently 2,493 people live on the islands, compared to the maximum of 7,711 in 1944. Major economic activities are agriculture, fishery, and tourism. The Islands enjoy unique ecosystem and belongs to Oceanian realm: the only Japanese place belonging to this realm. Because of this uniqueness the islands is also named as Eastern Galápagos Islands. The Islands are the home to many unique species which can be observed only in this place.

Bonin Islands were discovered by the Japanese in the 16th Century and were internationally recognized as Japanese territory in 1876. They attracted various countries including UK, US, and Russia, and developed through various economic activities including agriculture and fishery before the Second World War. In 1944, the inhabitants were forced to evacuate in the mainland and were not allowed to return home until 1968, when the Islands returned to Japan from the United States. While Okinawa was also under the US occupation until 1972, its inhabitants continued to live on the island, inhabitants of Ogasawara were forced to leave and were not able to return for more than twenty years. This is one of the reasons why the Islands are given special status among the territories [23]. Due to this discontinuity of life and economic activities on the island and because of the need to invest in infrastructure, the government enacted Special Law for Reconstruction of Bonin Islands in 1969. The law has been revised each five years and has renamed as Special Law on Development of Bonin Island in 1979. The revision requires participation of interested parts and academia, who take part of the Committee for the Development of Bonin Islands, under MLIT.

The special law guarantees investment to maintain and renew infrastructure, to support everyday life of the inhabitants through financial aid and direct service delivery, to promote new productive activities and employment, and to launch new experiments and projects. Last amendment was in 2014 and based on the revised special law, the Ministry issued Basic Guideline of the Development

¹² Okinawa (Islands and Prefecture) has a special status, given its unique characteristics; however it is under the Cabinet Office (CAO) [3].

¹³ Interviews were conducted to officials of MLIT, Ministry of Environment, and TMG, and researchers of Tokyo Metropolitan University stationed in the Island research centre.

of Bonin Islands and the TMG published Plan of the Development of Bonin Islands on the same year, in order to put the law into practice [24][36].

As a member of the Committee, which discusses the revision and evaluates the state of progress, the author observed the reality of the islands and participated in the two amendments in 2009 and 2014. During the work, the committee payed several visit to the island and regularly interviewed various actors of the islands and the related institutional actors.

4.2. Issues and policies

The major challenges of the islands are; transportation from mainland, thus the general high cost of life, including energy cost and other indispensables, limited stock of goods, limited delivery service, healthcare services and medical attention, education, communication, broadcasting, internet, and maintenance and renewal of infrastructure [23] [24].

The inhabitants' life is strongly bound to the schedule of the cargo line, which has limited trip and capacity. Thus in case of extremely bad weather like Typhoon, which can stop the trip of the ship for days, the daily necessities of the inhabitants and the tourists would be lacking¹⁴. All types of delivery are also bound to the only ship. This means that the shipment of products such as fruits, vegetables, and fishes is also strongly dependent on it. Thus, not only the cost, but also the time and schedule of the transportation affect the economy. Construction of an airport has been one of the biggest issues, thus the topic of the special laws and the development plans; however, because of technical difficulties and environmental issues, it has not yet realised so far¹⁵.

In order to guarantee equity and equality of public services, for example, the difference of energy cost from the national average is financed by the TMG and the higher cost of broadcasting is covered by the NHK, or Japan Broadcasting Corporation, and other private broadcasting company, as the broadcasting law requires the ubiquitous service to all territories. For the telecommunication services, after the privatization of national telecommunication company, the investment in the area has been small and always in delay compared to the rest of the territory. The services and companies operating in the territory have been limited, limiting the choice for the inhabitants.

Healthcare and educations are the most serious issues of the inhabitants, who are ageing on one hand, and who are giving more birth than other areas [26]. Patients with serious health condition which requires special medical attention have to be transported to mainland by Japan Coast Guard and Self Defence Force and expecting mothers have to deliver their baby in mainland. When it comes to education, there are elementary and secondary schools as well as a public high school, but students have to leave the islands to go to universities.

Maintenance and renewal of major infrastructure are a big issue for the Ministry and for the TMG. Major infrastructures, such as port and harbour, water purification plant, water supply and sewerage services, schools, affordable housings and clinic were built before the war or in the Sixties in a precarious way, and need to be renewed [23], but the cost of construction is extremely high, since

¹⁴ During the summer of 2015, several big Typhoons hit the area and caused serious problems for the inhabitants of the Island and the tourists.

¹⁵ Under the last development plan of 2014, environmental assessment and inhabitants' questioner were conducted in 2016.

every single piece of materials should be transported from outside¹⁶. There is also an urgent need to prepare for a possible big earthquake [23] and many old infrastructures needs anti-seismic intervention, which requires big investment as well as solving various practical issues.

The new challenges since the recognition of UNESCO World Natural Heritage are; the increasing tourists, lack of facilities and personnel, and environmental protection of the territory. The tourism industry is one of the major industry, thus the increasing number of tourist should be a positive sign; however because of the limited facilities and personnel, many of the tourists cannot be accommodated. Maintaining a unique ecosystem needs constant research, observation, management, and intervention, if necessary.

The Islands unique ecosystem with unique vegetation, habitat, and climate, has attracted international research community. The Ministry of Environment and the TMG with its Tokyo Metropolitan University have been investing to create world class research centre on the Islands. The centre has established a certain reputation on marine tropical vegetation research, climate research, and aquatic and mineral resource researches.

Various projects have been implemented according to the special laws and the development plans of the Ministry and TMG with their respective budget. Since the last special law was enacted in 2014, the major issue of the implementation of the plan has been the finance.

5. Digital Technologies and Co-production

Since the aim of the paper is to explore role of ICT, proved to be useful in improving services, the last part investigates what have been done and what are the future plans in various sectors.

Since the cost of transportation is the major financial burden for many other issues, ICT, especially digital technologies and satellite communication have been proving efficient. The government invested in the satellite communication in the area with some experiments of Japan Aerospace Exploration Agency (JAXA), and it has been widely used for telecommunication and broadcasting. For the internet services, the Islands are connected with broad band internet using optical fibre cable installed below the sea since 2011. More stable and cheaper communication has improved agriculture and fishery business, which relies heavily on the mainland market. Use of digital technologies have improved productivities of fruits and vegetables, but also in fishery business, which now operates with much technologically advances ships than it used to. The treatment and processing of fishes on the ship and at the port before the final products get shipped use market data, including price and demand. Thus the amount of catch and the excess would be under control.

Tomato is indeed one of the major agricultural products of the Islands which have an important market in mainland. Before the market analysis enabled by the mobile devices and big data, many farmers did not control their production and thus the price could have varied according to the market condition or could not simply meet the market demand. Now they control much better the production according to the demand of the market and ship their product when it is competitive.

This applies to passion fruit, acerola, and mango as well.

¹⁶ Construction of infrastructure such as water purification plant requires transportation of not only all necessary components, but also construction equipment as well as workers, who should stay on the Islands during the period of construction.

Healthcare services are also benefitting from the digital technology. The first has been introducing telemedicine and several smartphone applications, which check and control health conditions. The inhabitants are encouraged to use them, which have been serving as preventive healthcare. Since the medical personnel are limited, the medical service on the Islands is not ready to operate using remote operation system, but the facility can accommodate a series of operation.

Faster and stable internet connection has enabled remote work and study. As a consequence, the Islands have been registering impressively high rate of newly transferred residents in recent years. For example, in 2014, the Islands registered 11.2% new residents coming from outside and 2.3% natural increase, while the national average was 4.4% and 0.2% [25]. This means that the Islands have been attracting young peoples, who settled in the area, started their activities, formed family and gave birth. This has accelerated with the recognition as UNESCO World Natural Heritage and the tourism boom, but the technology has surely supported the movement.

Communication infrastructure with Massive Open Online Course (MOOC) have been helping young inhabitants to opt not leave the Islands, or at least continue a part of their higher education remotely. On this regards, the statistical data so far shows mix results, also because of the limited number of students of that age and thus it is not easy to draw conclusions. However the number of Twenty-somethings returning to the Islands after the higher education outside the Islands could show a positive trend. Number of activities started by young entrepreneurs is also increasing, according to the TMG statistics. Given the limited number, it might be misleading to stress the relationship, but it is possible to note the trend.

Lastly, an interesting field to be noted is the weather forecasting and natural disaster prevention. The Islands, despite the importance for its climate issues, contradictory, never had the proper weather station, but relied on various nearby facilities. On this regard, there have been discussions to build a proper weather station so that the Islands can become an important hub for the climate issue as well as natural disaster prevention issue. The same reason applicable for the renewal and new building of infrastructure, the option to build a new weather station on the Islands seem financially difficult, while they decided to continue to rely on a network of facilities which gather and provide data enough to analyse the micro situation of the Islands. Some of them are even private and commercial facilities. This reminds us of the service of Japan Meteorological Agency (JMA) during and after the East Japan Earthquake in 2011, when the major data came from a network of private, commercial, research institutions, even from international partners, along from the public structure [1]. The weather related data, indeed, can be gathered by various types of institutions, but easily assembled and analysed for a certain purpose, in some cases, could be vital to prevent disaster and to rescue people and property in the best and fastest way. This is a typical benefit of co-production of, and through, Big Data [21].

6. Conclusion: Findings and limitations

This paper aims to explore a particular case of unique territorial characteristics and analyse the potentials of digital technologies through the Japanese Islands of Bonin. Thus, the findings from the case have the strength of being realistic as well as authentic; however there are also limitations of being a single case study as well as because of limited period of observation.

When it comes to potentials of digital technologies in geographically difficult places, such as remote places from cities, mountains, forests, deserts, and places with extreme climate conditions, there are many researches and publications which studies about it and proved it. Indeed, many

developing countries in Africa, South and Central Asia, and South America are benefitting from these technologies, especially in agriculture, finance, and basic citizen services [15].

Several direct findings from the case of Bonin Islands are that the Islands have been benefited from latest mobile communication technologies as well as general ICT advancement in various fields. Installation of optical fibre cables enabled stable and reliable connections, which improved various services on the Islands as well as productions, especially given the difficulties to improve transportation means and thus the cost of various services. Many indicators show that the new services have had positive impacts on the Islands and the inhabitants of the Islands.

Interviews revealed that there are several issues such as capacity development on ICT among the young inhabitants as well as the elderly population of the Islands and the rather high maintenance cost of equipment on the Islands, if it would not be done locally. There are also limitations of these technologies, as they can improve several services, but would not resolve the problem of physical transportation of materials by cargo lines or airplanes.

As one of the original issues of the insularity has been the equity and equality issue, ICT has proved to be useful and accommodated the financial issues behind it. Thus, the possible potential of ICT could be on this point. Furthermore, several services provided through co-production of various actors using Big Data have proved to be quite efficient as well as effective as the case of JMA.

The results the case study contribute also to theoretical discussions, as they show that physical distance is not the only determinant and the absolute burden as illustrated in NEG, as the digital technology might compensate geographical distance element. The case contributes to the co-production of public service delivery discussion as well, since it is an example of it.

Given the limitation of one case study, the further research which will follow would be on several other cases, and on various other technologies, including use of Big Data and IoT.

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